

EMOTION MONITORING ONLINE SYSTEM - EMOSYS

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Abstract

This paper outlines the development, deployment and initial testing of a learning space environmental monitoring system. This system has been developed to monitor several environmental conditions including Temperature, Humidity, Sound Levels, Lighting levels and CO₂ levels. The paper presents some initial testing with the system and discusses initial findings on the emotional wellbeing of students from learning spaces that have been monitored.

Keywords: Technology, pedagogical research, arduino, learning environments.

1 INTRODUCTION

One of the most important factors relating to a students learning is based on the physical learning environment, i.e. the rooms, layout, equipment, etc. As a result of this drive to developing the learning environment, there is research and support into the field known as 'Learning Landscapes'. Jisc and the Higher Education Academy provide funding and support into this area. The University of Lincoln produced a report on their own research into Learning Landscapes [3] which showed that space utilisation of learning environments was only around 15% to 20%, after Funding Council support this increased to 25% during core teaching hours.

The research behind this report looked at the learning spaces of several different universities across the UK, to see how learning spaces were being utilised [1]. This project looked at the varying learning spaces available to universities for teaching, from Social learning spaces, to technology-rich environments. The research here focused predominately on the layout of usage of the environment and how it could be configured to allow for effective learning and space utilisation.

There has also been substantial research conducted on technology solutions for improving student engagement through the notion of active learning, interactive delivery of course materials and the use of technology in the classroom [2]. The University of Lincoln, UK over the past few years has been developing a new approach to active student participation through an initiative known as Student as Producer (<http://studentasproducer.lincoln.ac.uk/>). This treats the student not as the consumer but rather the producer of knowledge and develops them into active learners.

All these initiatives contribute towards creating a much richer and vibrant learning environment for students to engage in. However, these ideas and initiatives focus predominately on the physical properties of the learning environments in which students find themselves in, such as the use of technology i.e. projectors, intelligent whiteboards, or the layout of the room, position of desks, etc.

However, there are many different types of classrooms available in educational institutions, such as raked lecture rooms, seminar rooms, open plan, closed plan and whilst these are available in many different shapes and sizes, they are predominately seen as a static structure.

2 ENVIRONMENTAL FACTORS

As discussed previously, the learning environment is vital to the importance of student learning and engagement, however, it does not stop at the physical layout or use of technology as student engagement can be heavily impacted by the learning space environmental conditions. As such the research presented in this paper looks at monitoring and analysing the environmental conditions of the learning space and correlating this with student engagement, satisfaction and attainment.

2.1 Metrics for Measuring effective learning

It is commonly accepted that the temperature and humidity of a room can influence how alert the occupants are. Anecdotal evidence suggests that when a room is 'hot and stuffy' that all one wishes to

do is fall asleep. It can therefore be seen how this could certainly impact a student's ability to concentrate or learn effectively.

Indeed, the environmental conditions of an environment affect how we feel, our emotional state and our ability to focus on tasks. It is widely believed that a person's current emotional state influences how they learn. Sylwester [4] draws together a lot of good research on the issue stating "*We measure spelling accuracy, [but] not emotional well-being.*" Here Sylwester was referring to the metrics by which we measure learning. The we focus on the post-learning metrics, i.e. 'what has *been* learnt?' rather than by what effects learning in the classroom, and therefore how we discard the just as important factors such as our states of wellbeing *during* the learning process.

2.2 Environmental Monitoring

In order to monitor these environmental conditions we present in this paper details of the environmental monitoring devices we have constructed. These environmental monitoring devices record the following environmental conditions throughout the duration of a lecture: Temperature, Humidity, Light Level, Background Sound, CO₂ levels and current time.

These environmental conditions are monitored every 15 seconds and post processed to see if any particular trends emerge for which conclusions can be drawn. The data is also compared across varying lecture rooms, cohorts of students and different subjects in the hope this again leads to further correlations in the data.

The monitoring systems are built using an Arduino and associated sensors. Tables 1 shows a list of the sensors and components used with costs. Figure 1 below shows the early prototype of the monitoring system with the MicroSD card for recording data and Temperature/Humidity sensor.

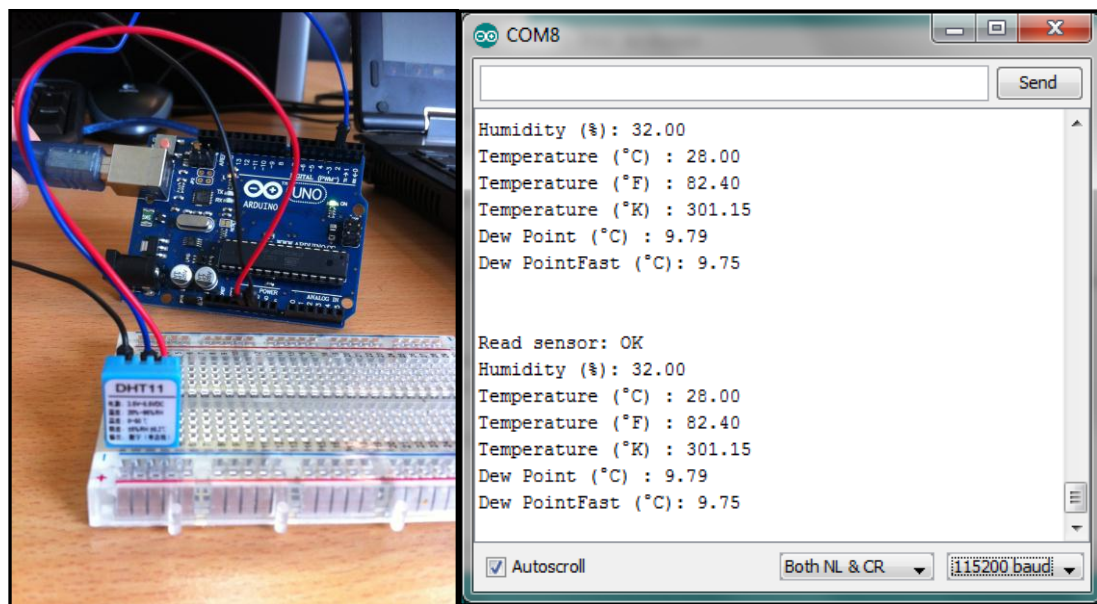


Figure 1 - Shows the initial prototype of the Environmental monitoring system recording temperature and humidity.

Component	Cost	Source
Arduino Uno R3	£10	Hobby King
Temperature / Humidity Sensor (DHT11)	£3	Adafruit
microSD Card reader / writer	£10	Adafruit

Realtime Clock	£5	Adafruit
Sound Sensor	£8	Picto-Pic
Light (strobe) sensor	£5	Prto-Pic

Table 1 - Lists the components used to develop the environmental monitoring system, costs and source.

2.3 Monitoring Emotional Responses

At the end of the lecture, workshop or seminar as the students are leaving the room, they have the opportunity to record their current emotional state or how they feel. This is done via a touch screen tablet. The student are presented with a selection of emoticons that reflect certain feelings of wellbeing, for example these include: Tired, Hot, Cold, Annoyed, Happy, Alert, etc. An example of this is shown in Figure 2 below.



Figure 2 - Depiction of the emotive selection panel students are asked to vote on at the end of a lecture. The icons relate to how they are *currently* feeling at the end of the lecture.

Utilising this method of recording the students current emotional wellbeing provides many advantages over questionnaire or form based methods in that it takes much less time as the students need just touch the image that they associate with, the feedback is instant and it is intuitive to use. This data is then stored with the environmental monitoring data for later analysis.

3 DEPLOYMENT AND TESTING

The environmental system is being deployed in many of the lecture, seminar and workshop rooms throughout the university of Lincoln. The sensor system is placed as central in the room as is possible but sufficiently far enough away from any people in the room so as not to be disturbed by proximity to any individual.

The time and location of the device is recorded so that data can be related back to the environment for which it was taken. The touch screen tablet is also placed near the exit of the room, ready to be used as and when students leave (this is also to catch data from students who may leave early).

3.1 Results

Due to the time of year that this system has been completed and due to the academic calendar and taught lectures finishing around mid-May 2014 it has not been possible to collect enough data to make any conclusions or correlations between engagement and environmental conditions. However, from initial experiments some interesting discoveries were made which lead to an insight into the temperature and humidity of particular learning spaces.

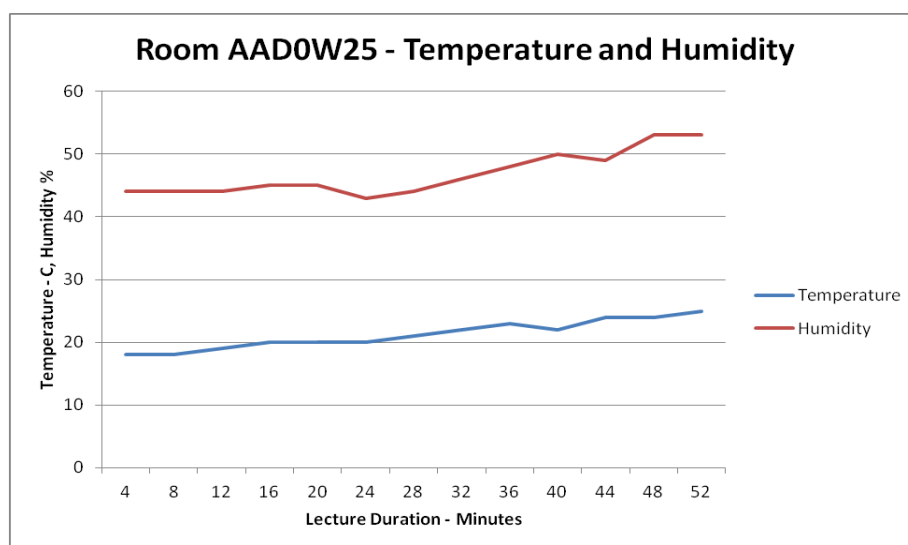


Figure 3 - Temperature and Humidity values for room AAD0W25. Time starts at 9am, lectures runs for 50 minutes. This lecture had approximately 140 students.

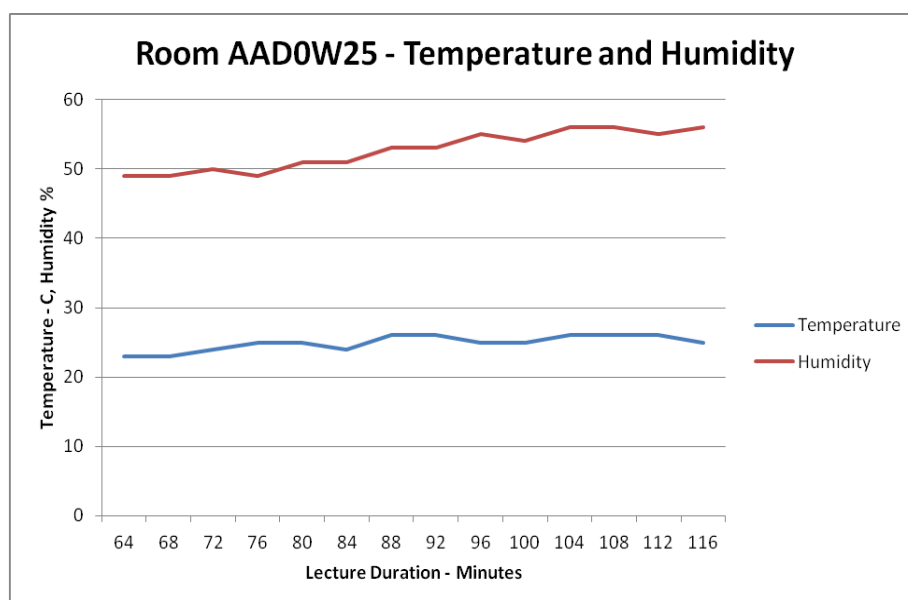


Figure 4 - Temperature and Humidity values for room AAD0W25. Times starts from 10am and lecture runs for 50 minutes. This lecture had approximately 80 students.

The room AAD0W25 is a large raked lecture theatre that sits approximately 100-150 students. This is an internal room with no windows, but 'centrally managed' air conditioning. As can be seen from Figure 3, the first recording of the day for this room started with a relative humidity of 44% and a

Temperature of 18°C, after the 50 minute lecture this had increased to a humidity of 53% and a temperature of 25°C. This demonstrates how quickly the temperature and humidity conditions of a room can quickly increase.

The same room had a lecture scheduled directly after that shown in Figure 3. There are roughly 10 minutes between lectures to allow for students to leave, and new students to enter and for the lecturer to set up any equipment. During this time, the temperature of the room AAD0W25 had dropped 2°C to 23°C and the humidity had dropped 4% to 49%. However, this quickly rose to 28°C and 56% humidity during this lecture period.

Due to the nature of this room being one of the largest capacity rooms on campus it has a relatively high utilisation capacity, as such the room does not have much chance to return to its initial state of 18°C and 44% humidity.

In terms of emotional wellbeing, we asked each of the students to select one emoticon from the top row and one from the bottom row as shown in Figure 2, to describe how they were feeling after their respective lectures. These results are shown in Figure 5.

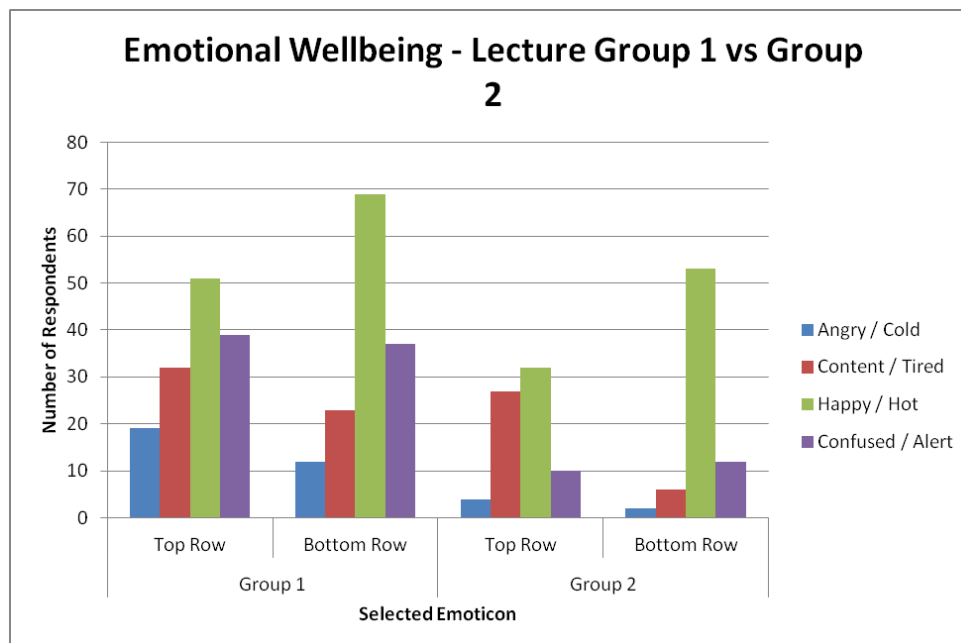


Figure 5 - The emotional wellbeing results from the lectures shown in Fig's 3 and 4. Top row relates to Angry, Content, Happy, Confused. Bottom row related to Cold, Tired, Hot, Alert; as shown in Figure 2.

As can be seen from Figure 5, the first set of students had 1/6th who felt Tired with more than 1/2 feeling hot. Contrast this with the second group of students where only 1/14th felt Tired, and more than 2/3rd of the students opting to vote for Hot. This shows how the raised temperature and humidity levels of the learning space influence emotional wellbeing.

4 CONCLUSIONS

The system presented in this paper allows for environmental factors of a learning space to be monitored and correlated against the self assessment of the student's emotional wellbeing when they are leaving the lecture.

We have deployed this system initially in a limited number of lectures, however a much longer study will need to be conducted in the new academic year. However, from the initial studies complete, it can be seen that monitoring the environmental conditions of the learning space yields interesting insights. It is evident that when a room is in continuous use it raises the humidity and temperature of a room without allowing it to fall back to comfortable levels. This can have an effect on the emotional wellbeing of the student, and potentially their learning. This will need to be investigated in much more detail in the future runs of the project.

5 FUTURE WORK

This system is being deployed throughout a large number of the learning spaces at the University of Lincoln. The environmental monitoring system will be used to record environmental conditions of these learning spaces for the academic year 2014/15, once enough data has been collected and enough students have performed a self assessment of emotional wellbeing as they leave the monitored lecture then correlations will begin being explored on student engagement and attainment in terms of learning space environmental conditions.

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